

# IDC Total ET and ETpr/ETaw Split Experiences

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# Agenda

- Importance of ETpr/ETaw split
- Soil parameters and the ETpr/ETaw split
- Calibration of soil parameters
- ETpr/ETaw split results
- Root Growth and the ETpr/ETaw split
- Checks on total ET results
- Summary

# Importance of ETpr/ETaw split

- Quantifying the Efficiency of Agricultural Water Use  
Draft report 11/1/2011
  - 3 indicators require an estimate of ETaw
- Water Management Plan Water Balances

# IDC ETpr/ETaw Split Results

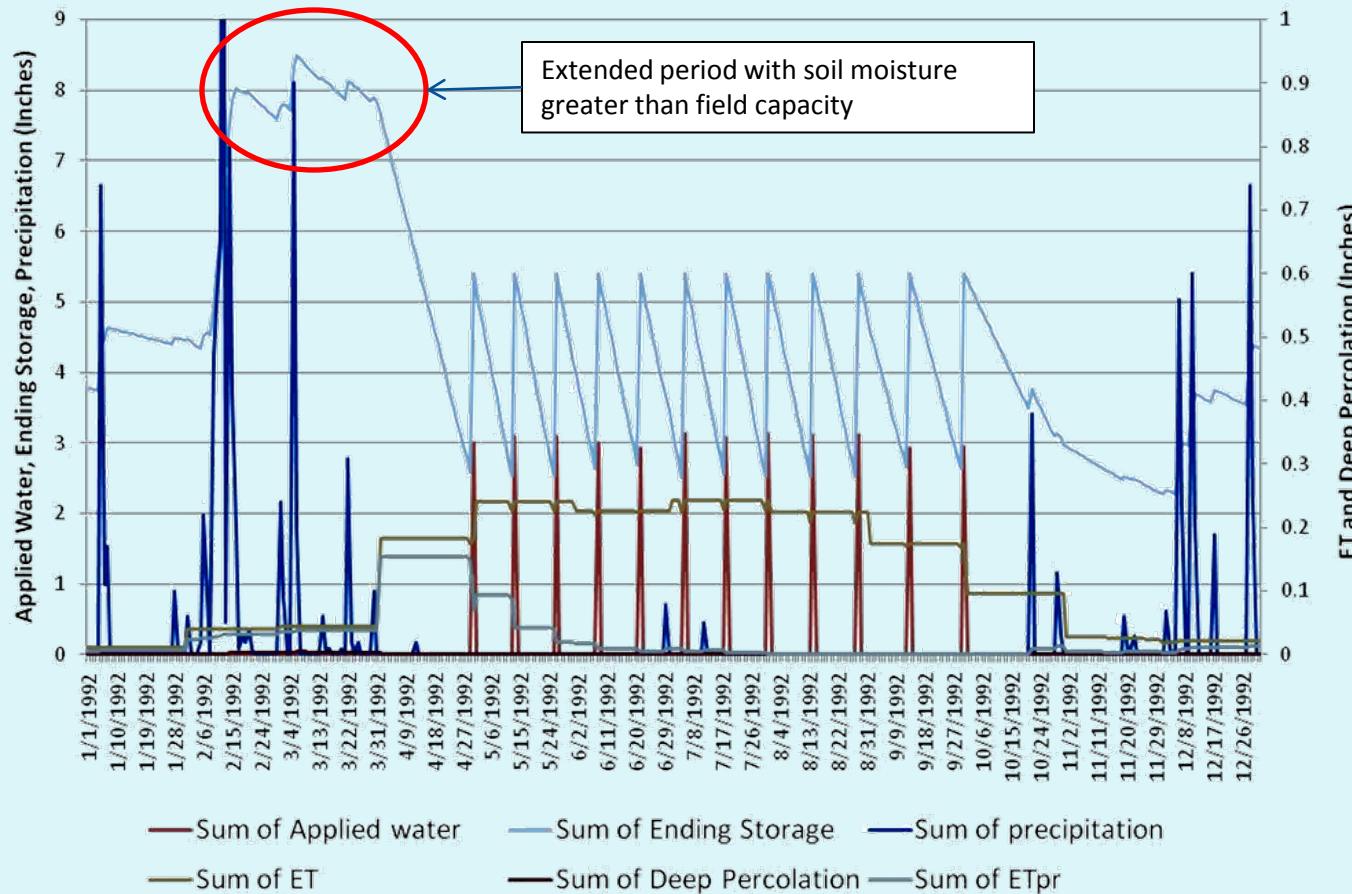
- IDC Users Manual—Example 2
  - IDC results show less ETaw than DPLA estimates
- DE Root Zone Model
  - Spreadsheet
  - Monthly time step
  - Tracks precipitation, applied water and ET
  - IDC results show less Etaw than DE Root Zone Model results

# ETpr IDC Results compared to DE Root Zone Model Results (Inches)

Year	DE	IDC	Percent Difference
1991	7.58	10.35	37%
1992	5.09	7.94	56%
1993	7.64	10.54	38%
1994	8.26	7.32	-11%
1995	7.50	11.98	60%
1996	9.21	10.43	13%
1997	5.51	7.47	36%
1998	10.13	13.64	35%
1999	7.11	8.25	16%
2000	8.52	9.64	13%
2001	8.72	8.82	1%
2002	5.22	7.15	37%
2003	6.03	7.75	29%
2004	5.97	6.81	14%
2005	9.58	10.12	6%
2006	8.91	10.44	17%
2007	6.15	7.09	15%
2008	5.88	6.71	14%
Average	7.39	9.03	24%

# IDC Simulation Results

## (Average Soil Parameters, Total Porosity = 41%)



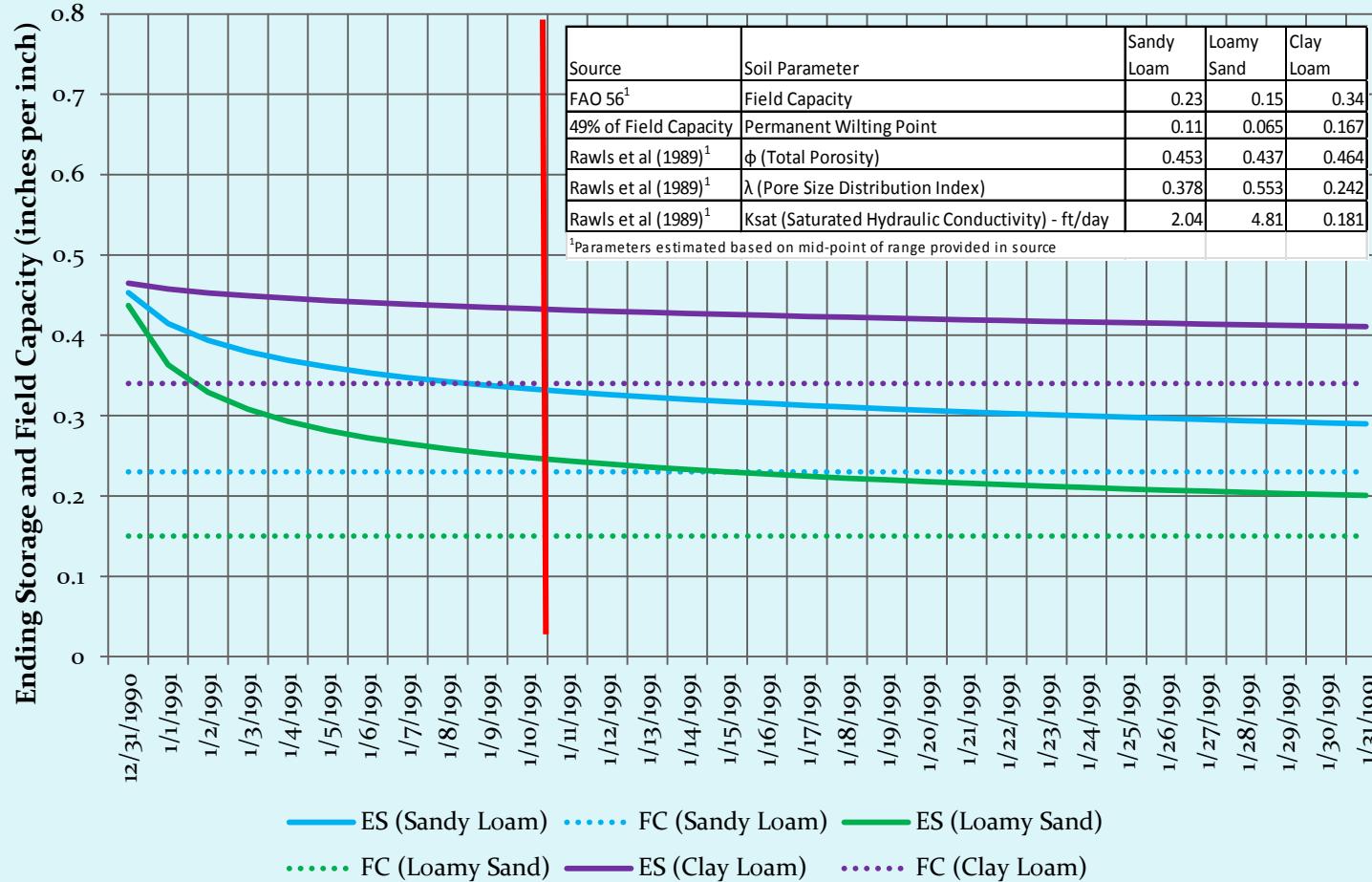
# Soil Moisture Observations

1. Soil moisture stays above field capacity for 60 days
2. Ritchie (1981) notes: “considerable drainage occurs after 3 days, although about 70% had occurred by then. After 10 days (240 hr), drainage had practically stopped and the water content profile at that time was near the drained field capacity. “
3. Other references support water content above field capacity draining in 10 days. (Journal of Irrigation and Drainage, Soil Science, FAO)

# Soil Parameter Calibration Steps

1. Isolate the soil drainage portion of the IDC model
  - a. Set precipitation and evapotranspiration to zero for all time steps within the model
  - b. Set the initial soil moisture equal to the  $\phi$  (Total Porosity).
2. Run the model for a clay loam using average soil parameter values.
3. Run the model for the area-wide average soil texture, sandy loam, and the other prevalent soil texture (loamy sand) for comparison purposes using the average parameter values.

# Initial Model Run (Avg. Soil Parameter)



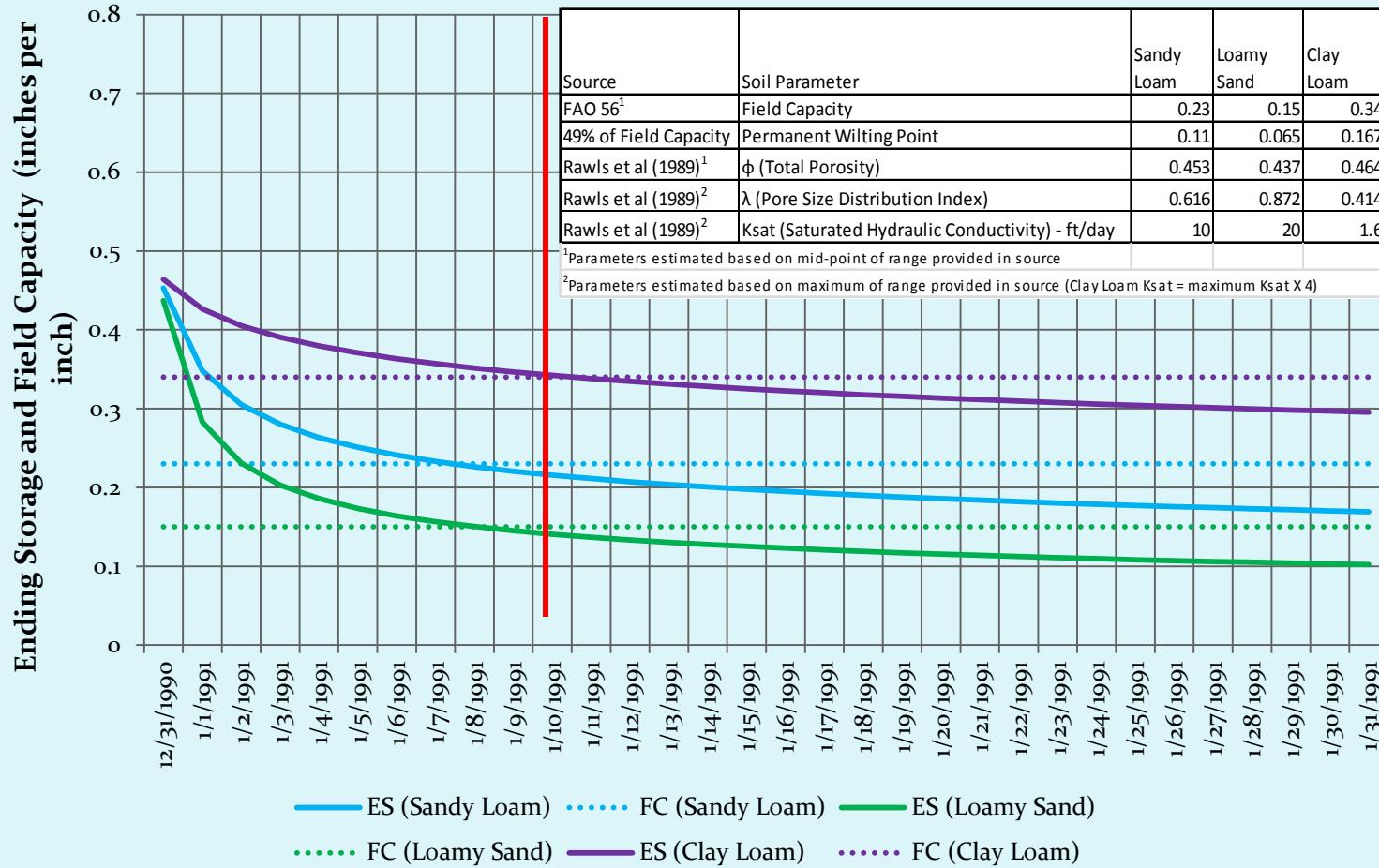
# Soil Parameter Calibration Steps (cont.)

4. Revise (scale) the  $\lambda$  and  $K_{sat}$  parameters to get the “clay loam” soil to drain in 3 to 10 days, per Ritchie, 1981.
  - a. Measured soil moisture content for Adelanto clay loam
  - b. 70% drainage in 3 days
  - c. Drainage “nearly stopped” in 10 days
5. Revise the  $\lambda$  and  $K_{sat}$  according to the required scaling found in Step 4.

# Soil Parameter Calibration Steps (cont.)

6. Run the model with the “scaled” parameters from Step 5 and confirm (or refute) that the number of days to drain “makes practical/physical sense.”

# Final Model Run



# Comments on Calibrated Soil Parameters

- Do the calibrated soil parameters make practical/physical sense?
- Calibrated Ksat values are higher than typical ranges reported for soil textures
- Calibrated lambda at maximum for ranges reported for soil textures

# Comparison of Average Annual Values to the DE Root Zone Model

Component		Sandy Loam	Loamy Sand
Precipitation	IDC	12.91	12.91
	DE	12.91	12.91
	IDC Diff	0%	0%
ETc + Evap from Precip	IDC	45.15	45.20
	DE	45.67	45.67
	IDC Diff	-1%	-1%
ETaw	IDC	38.04	38.99
	DE	38.23	38.23
	IDC Diff	0%	2%
ETpr	IDC	7.11	6.21
	DE	7.39	7.39
	IDC Diff	-4%	-16%
DPpr	IDC	4.75	5.66
	DE	4.22	4.22
	IDC Diff	12%	34%
Ropr	IDC	1.29	1.18
	DE	1.29	1.29
	IDC Diff	0%	-9%

# Root Growth Parameter Development

- Off-season rooting depth = 6 inches
- Maximum rooting depth = mid-point for range from FAO 56
- Linear growth between plant date and maximum Kc specified as daily input

# ETaw/ETpr Split with and without Root Growth

Crop Name	ET <sub>aw</sub>			ET <sub>pr</sub>		
	IDC without Root Growth	IDC with Root Growth	Diff	IDC without Root Growth	IDC with Root Growth	Diff
Beans	18.57	21.45	2.88	4.68	1.79	-2.90
Berries	16.84	18.45	1.62	3.30	1.68	-1.62
Corn	23.52	26.62	3.10	4.91	1.68	-3.23
Oats Corn	34.22	34.62	0.40	5.19	4.63	-0.56
Peas	22.25	23.66	1.41	3.32	1.77	-1.56
Small Grain	17.70	18.36	0.66	5.19	4.45	-0.74
Squash	22.51	23.96	1.45	3.48	1.87	-1.61
Sudan	21.47	25.06	3.59	5.25	1.37	-3.88
Sunflowers	17.24	20.26	3.02	4.71	1.75	-2.96
Sweet Potatoes	21.97	23.14	1.16	3.01	1.78	-1.24

# Total ET Checks

- Total ET input to IDC
  - CIMIS ETo
  - Crop Coefficients (ETa/ETo ) with ETa from Surface Energy Balance Algorithm for Land (SEBAL)\*
- Total Annual ET for crop according to IDC should equal SEBAL ET
- Check against other years of SEBAL ET data where available

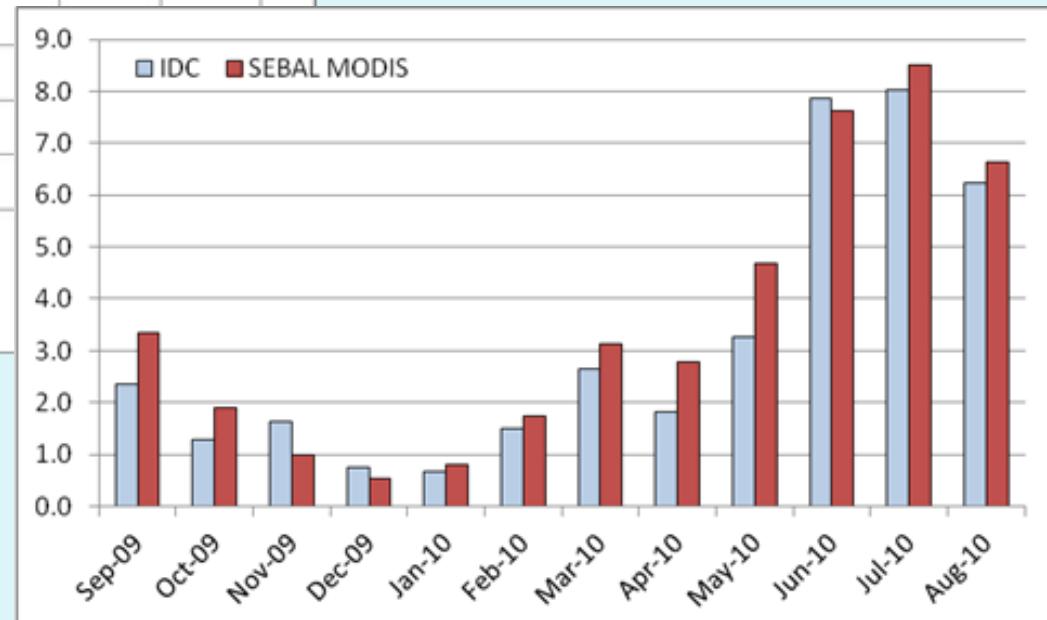
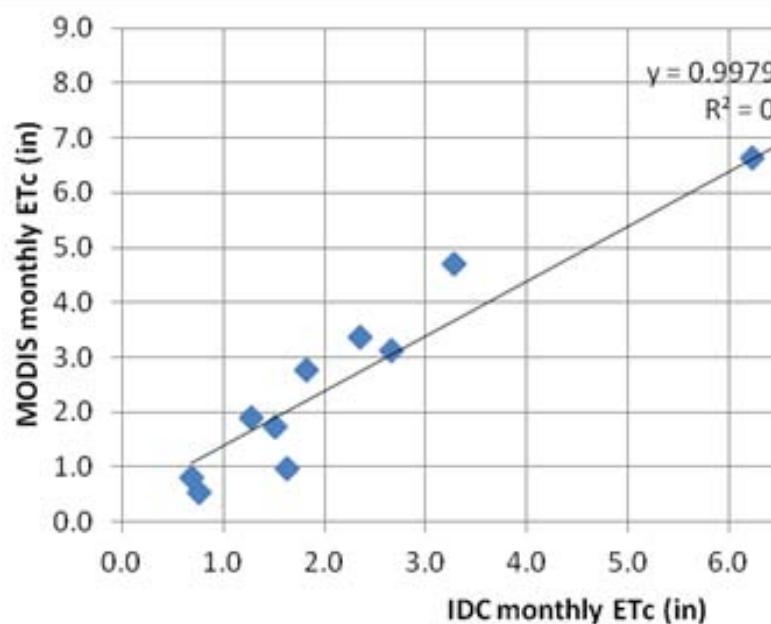
\*For more information see [www.sebal.us](http://www.sebal.us)

# ET Checks (Sacramento Valley)

2007 – Second Year Check				2001 – Kc Development		
Month	IDC	SEBAL	Difference	IDC	SEBAL	Difference
1	0.44			0.30		
2	0.49			0.41		
3	0.94	1.43	0.49	0.88		
4	2.04	1.91	-0.13	1.84	1.15	-0.69
5	5.08	4.72	-0.35	5.31	6.17	0.86
6	8.33	7.70	-0.64	8.40	8.88	0.49
7	8.37	7.75	-0.62	8.36	8.07	-0.29
8	6.78	6.88	0.11	5.95	6.64	0.69
9	3.30	4.09	0.79	3.17	2.99	-0.18
10	1.59			1.62		
11	0.47			0.42		
12	0.29			0.19		
SEBAL Period	34.83	34.48	-0.35	33.03	33.90	0.88

# ET Checks (Sacramento Valley)

## – 3<sup>rd</sup> Year Check for 2010



# Summary

- Need to Calibrate Soil Parameters so that soil moisture above field capacity drains in about 10 days to ensure reasonable results for the ETaw/ETpr split
- Root growth does affect the ETaw/ETpr split
- Compare Total ET results to input